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HIGH INCIDENCE OF TYPHOID IN SMALL EPIDEMIC.

AN OUTBREAK PRESUMABLY DUE TO THE EATING OF SALAD PREPARED BY A PERSON IN THE EARLY STAGES OF THE DISEASE.

By JAMES P. LEAKE, Passed Assistant Surgeon, United States Public Health Service, and RICHARD MESSER, C. E., Sanitary Engineer, Virginia State Board of Health.

On the evening of June 28, 1920, a dinner was given at Hopewell, Va., a community of approximately 7,000 population, at which 90 persons were present. Subsequently, from 5 to 23 days after the dinner, 49 of the 90 persons attending became ill enough to be confined to bed. The man who took to bed 23 days after the dinner had had an unusual headache since the ninth day. No other incidence of typhoid fever is known to have occurred in the community this season.

Some of the cases were typical cases of typhoid fever, but the disease corresponded to the recognized features of an outbreak caused by a very heavy infection of food with multiplying typhoid bacilli. The especial features of the outbreak were as follows:

1. The incubation period, in general, was short, the average being 10 days from the date of the dinner to the date of going to bed, 8 days for the more pronounced cases.

2. Many cases had a sudden onset, with severe symptoms.

3. There was a high incidence (54 per cent) among those persons exposed. Simultaneously there occurred among the persons who attended the dinner 9 other cases of illness of from 3 to 17 days duration, not severe enough to warrant confinement to bed. If these cases were included, the incidence rate would be 64 per cent.

4. The course of the disease was generally milder and shorter than the usual course of typhoid fever.

5. There were many atypical cases.

6. The disease occurred in spite of previous vaccination against typhoid (51 per cent of the histories) and even in some who had had typhoid fever (7 per cent of the histories). On the other hand, of those who attended the dinner but did not get sick, about 70 per cent had been vaccinated and about 40 per cent had had typhoid fever. Up to August 20 there had been 13 deaths, making a

mortality rate of 6 per cent among those persons who were the more seriously ill.

The rarity of such intense outbreaks of typhoid and the lack of correspondence to typhoid fever as seen in the usual hospital ward caused confusion in diagnosis in this instance. It was thought at first that some other factor of food poisoning was present.

There is no known form of food poisoning other than that of the typhoid group with such an incubation period as was shown in this outbreak. That the disease was true typhoid was proved by agglutinins (1:100 to 1:8,000) in the serum of the patients, even in some of the atypical cases, and by blood cultures, which were positive for the typhoid bacillus in 8 out of the 18 cases tried. The single autopsy was typical of typhoid fever, with marked hyperplasia of Peyer's patches, solitary follicles and mesenteric glands, and with intestinal hemorrhage as the immediate cause of death.

The only article of food at the dinner which was eaten by all who became sick was a chicken salad. This salad was placed on lettuce from different gardens, but many of those persons who did not eat the lettuce became sick. The chicken, veal, and celery used in the salad could not be brought under suspicion on account of their varied sources.

The member of the dinner committee who prepared the mayonnaise dressing had been tired and complaining for about a week previous to the dinner, though she was usually very active and free from any disability. After the dinner, her physician and his wife, knowing that she was sick, took her home by automobile. During the succeeding week, though up and about, she did not return to the hall, where the dinner had been given, to secure her dishes. Seven days after the dinner she took to her bed and became seriously sick, her attack being described by some of the physicians as one of the most typically typhoidal of the group. She had not received typhoid vaccine for 3 years, but her serum agglutinated at 1:200, and a blood culture yielded typhoid bacilli 16 days after the dinner. About 13 days before the dinner she had spent an evening in an adjoining county, but had made no other visits out of town nor received visitors for some months previously. None of her family (consisting of husband and four children) was taken sick, although she and her elder daughter prepared the meals. Her husband had typhoid fever 23 years previously.

Assuming that the mayonnaise dressing was the origin of the outbreak, the freedom of the other members of the family from the disease may be explained either as chance natural immunity, or on the assumption that the hands of the mother were heavily contaminated at the time when this dish was prepared, but on no occasion when she prepared uncooked food for her household. The only other

member of the family who attended the dinner, except the husband, was the younger daughter, and she ate no salad. Parts of all other articles of food on the menu were carried to various homes after the dinner, but the salad barely sufficed for the second table, at which the committee, some children, and some late comers were served. No illness occurred in these other homes in persons who did not attend the dinner.

The mayonnaise was prepared about as follows: At 9 o'clock on the morning of the dinner a can of cottonseed oil, a dozen egg yolks, two teaspoonfuls of salt, and somewhat less than as much juice as could be squeezed with one hand from two lemons were mixed by beating the yolks with a silver fork, adding the oil slowly, then the salt, and the lemon juice, drop by drop. The beating continued until the dressing reached the proper consistency. The yellow glazed mixing bowl containing the dressing was placed in the bottom of the household ice chest until 2 p. m., when it was taken to the hall and placed on a shelf in the pantry.

From 5 o'clock until 8.30 the mayonnaise, together with the other components of the salad, but in separate dishes, stood on ice. The mixed chicken, veal, and celery, with mayonnaise on top, were then placed on lettuce leaves on each plate at the table. The maximum temperature of the day, 31° C. (U. S. Weather Bureau), occurred while the dressing stood on the pantry shelf.

Prof. William Mansfield Clark of the Hygienic Laboratory, United States Public Health Service, found egg yolk to have a p_H value¹ of approximately 6.0, while egg white is of the order of p_H 9.0; lemon juice alone has a p_H value averaging 2.2. J. H. Wright found that the maximum growth of typhoid bacillus occurred at p_H 6.0 to 6.5. The temperature of 31° C. would favor rapid proliferation. The brand of cottonseed oil used has been found, in work with lipo-vaccines, to maintain rather delicate organisms alive for long periods. The acidity of lemon juice is not sufficient to kill bacteria which may be washed down from the hands in the act of squeezing the lemons.

A single trial under conditions approximating as closely as possible those of June 28 as to assumed mode of infection of the salad dressing and as to temperature, showed that typhoid bacilli would remain alive and apparently multiply in mayonnaise prepared by the above recipe. Plates made from the experimental salad immediately, $1\frac{1}{2}$, 3, and 24 hours after mixing showed a progressive increase in growth of typhoid bacilli, but numerical comparisons were impracticable on account of the oily nature of the menstruum.

The Widal reactions and the blood cultures, which form an essential part of this investigation, were made by Mr. Straus, bacteriologist of the Virginia State Board of Health.

¹ The p_H value of a solution is an expression of its hydrogen ion concentration or true acidity; the lower the p_H value the greater the acidity. A neutral solution has a p_H value of about 7.5.